

## 14.

Field Notes on the Lizards  
of Kartabo, British Guiana, and Caripito, Venezuela.Part 1. Gekkonidae.<sup>1</sup>

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(Plates I-VI; Text-figures 1-6).

[This contribution is a result of various expeditions of the Department of Tropical Research of the New York Zoological Society to British Guiana and to Venezuela, all made under the direction of Dr. William Beebe. The Guiana expeditions were made during the years 1909, 1916, 1917, 1919, 1920, 1921, 1922, 1924 and 1926, and the Venezuelan trips in 1908 and 1942. The latter was sponsored by grants from the Committee for Inter-American Artistic and Intellectual Relations and from four trustees of the Zoological Society, George C. Clark, Childs Frick, Laurance S. Rockefeller and Herbert L. Satterlee, and by invaluable assistance from the Standard Oil Companies of New Jersey and Venezuela.]

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## INTRODUCTION.

In the year 1909, and from 1916 to 1926, eight expeditions went out from this department to British Guiana, and in 1908 and again in 1942 field work was carried on in Venezuela.

Throughout the course of these expeditions many field notes, color plates and photographs were made of tropical vertebrates, and the object of this present series of papers is to assemble and publish these notes and illustrative material. Any change or alteration of the original notes is placed between brackets. The chief value of these data is that they are concerned with living or recently killed specimens.

The observations in Guiana were made in one-quarter of a square mile of jungle at Kartabo, and those in Venezuela at or close to Caripito, which is only 528 kilometers northwest of Kartabo.

In addition to numerous technical papers in *Zoologica* and several popular volumes, there have been published the following general ecological summaries: *Zoologica*: (Kartabo) Vol. II, No. 7, 1919, pp. 205-227; Vol. VI, No. 1, 1925, pp. 1-193; (Caripito) Vol. XXVIII, No. 9, 1943, pp. 53-59. Also see "Tropical Wild Life In British Guiana" by Beebe, Hartley and Howes, published by the New York Zoological Society, 1917, pp. 1-504.

My hearty thanks go to Dr. Charles M. Bogert of the American Museum of Natural History and Dr. Karl P. Schmidt of the Chicago Natural History Museum for identification and for bringing up to date my out-worn names of many years ago.

My original field numbers and other data have been appended to descriptions, breeding and other notes. These specimens are either in the collections of the Department of Tropical Research or in those of the American Museum. In the latter case the original field numbers are still attached, with the additional catalogue numbers of the Museum. Whenever the term total length is used, a perfect, unregenerated tail is understood. Most of the figures in the plates are black and white reproductions of original color paintings, so only the pattern is preserved. The following are from photographs of living specimens taken in the jungle: Pl. II, Fig. 4; Pl. IV, Figs. 9, 10; Pl. V, Fig. 14; Pl. VI, Fig. 16.

## FAMILY Gekkonidae.

Eleven species of geckos were found at the two localities of study, Kartabo and Caripito, ten at the former and three at the latter. Only one of the Venezuelan species was absent from Kartabo. One of the

<sup>1</sup> Contribution No. 694, Department of Tropical Research, New York Zoological Society.

latest check-lists of South American lizards (Burt & Burt, 1933) records nine species of this family from northeast South America, of which we found every one in our restricted areas. In addition we studied two others at Kartabo, one of which (*Gonatodes humeralis*) was previously recorded only from the basin of the Upper Amazon, and the other (*G. caudiscutatus*) from Colombia and Ecuador.

Some species of this family of small, very primitive lizards are familiar to every visitor to the tropics. They are not uncommon, they usually are provided with voices, and several are almost certain to be found in houses and camps situated near woods or jungle. Although perfectly harmless these geckos are universally feared by the natives, who call them by such names as Fathers of Leprosy and Poison Shooters. Most are nocturnal and are without movable lids to the eyes, and furnished with vacuums of sorts on the soles of the feet, enabling them to cling to and run over smooth vertical surfaces.

Geckos breed for the most part in the long rainy season and the eggs, one or two in number, are deposited in mould or the dust of decayed logs and other suitable places in the jungle.

Patient study of the habits of geckos might very probably yield interesting results for they are very primitive even for reptiles. No fossil forms of the family have been found but the remains of closely related lizards are known from the early Mesozoic, and we know that more than one hundred million years ago their tails were being shed as a means of safety first. Even today, geckos carry around with them such indelible proofs of their primitiveness as amphicoelous vertebrae, the presence of intercentra and an occasional well-developed second branchial arch.

***Gonatodes albogularis*** (Dumeril and Bibron, 1836).

**Names:** Stripe-shouldered Gecko; Black-and-white-tailed Gecko.

**Range:** Northeastern South America and the Dutch Leeward Islands.

**General Account:** In Caripito, both in abundance, in habits and in superficial appearance, this little gecko takes the place of *G. annularis* as we had found the latter at Kartabo, 528 kilometers to the southeast, south of the Orinoco. In notes on a collection of lizards from Surinam, Van Lidth de Jeude lists "Three specimens [of *albogularis*] with coloration of upper parts resembling closely those of *G. annularis*." I found, however, no record of *G. albogularis* either in the Georgetown Museum or in my eight years in the field in British Guiana.

My field name for temporary use was "stripe-shouldered" as compared with "spot-shouldered" for the other species and suggests one good distinction, this very characteristic marking being in *albogularis* in life rather a large, irregular blotch of brown or black with a vivid white streak across the middle, than the round black ocellus, more or less bounded with lighter color. The fully developed males usually possess some dorsal red, and the markings of the back and tail recall the very pronounced pattern of the females and young of *annularis*. All the dorsal markings, especially the terminal black and white caudal bands, are emphasized in newly hatched individuals. (Pl. I, Figs. 1 and 2).

Many of these lizards were taken in our pits, showing that they were active on the ground at night. The majority thus captured were in Pit 13, which was the only one actually in open savanna, about thirty feet from low second growth. No other species was found in this particular pit, but for several weeks stripe-shouldered geckos fell in by ones and twos. When two were found at once, they were, except in one instance, both males or both females, emphasizing the solitary or at least unpaired habits of these lizards. An unusually large number were in Pit 13 in early April, several weeks before the rainy season began. Three individuals lived in the laboratory, visible mostly at night high up on the walls.

Male, not breeding, body length 30 mm., total length 66 mm. (No. 30,043, Caripito, April 11, 1942, Color Plate 1538):

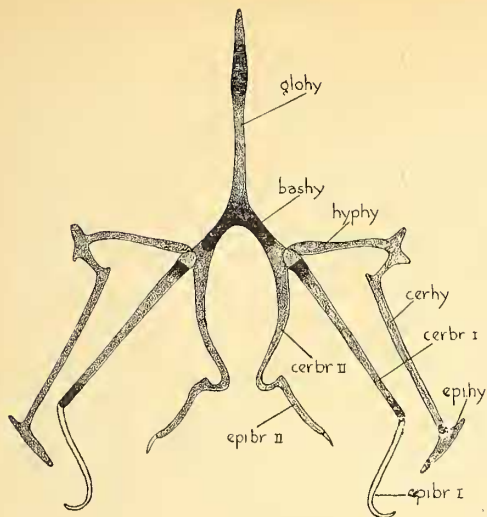
**Color in Life:** Upper parts grayish-brown, with paler gray lines on the head and a wide vertebral band to beyond the base of the tail. A dark brown humeral blotch bisected by an irregularly crescentic, transverse band of pure white, almost meeting on the mid-back. Back and limbs marbled with shades of brown and freckled with white. At the posterior insertion of the hind limbs is a small paired imitation of the humeral marking, small jet black spots flanked posteriorly with white. These are repeated six times down the tail, spreading out posteriorly into broad, black and white bands.

Lower labials dull lemon, chin and throat bright lemon yellow, fading posteriorly into yellowish-gray. On the chin are three large spots of rich orange, and behind these, three converging bands of the same color, freckled with brown. Iris mottled with two shades of brown.

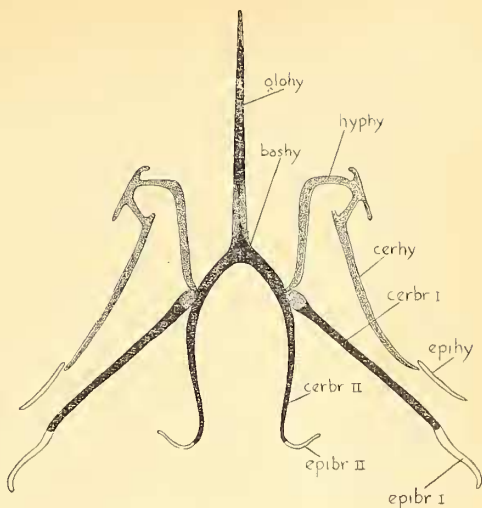
Breeding male, body 36 mm. (No. 30,100, Caripito, Pit 4, May 14, 1942):

**Color in Life:** Dark brown; tip of snout white; faint patch on occiput; white line at insertion of fore limb, extending up and





TEXT-FIG. 1. *Gonatodes albogularis*. Hyoid of 24-hours-old lizard.  $\times 15$ .



TEXT-FIG. 2. *Gonatodes albogularis*. Hyoid of adult, breeding female.  $\times 11$ .

obliquely back, almost meeting its fellow at mid-back. Lores reddish. Indian red line around antero-inferior circumference of eye; a broad red line back from eye below white stripe; another red line on side neck back to shoulder stripe; a few indistinct red spots on body. Below cold gray.

Breeding female, body 35 mm., total length 75 mm. (No. 30,093, Caripito, Pit 4, May 6, 1942):

*Color in Life:* Pale brown on head, back and limbs. A very wide dark brown band from ear to half down tail each side of the body. the upper side of this band is zig-zag, cutting into the dorsal light ground color with a series of angled points. Legs mottled brown. In front of the shoulder is a large white blotch, surrounded by a wide light area, and this in turn by a black band, all these frames being open in front toward the head. Chin and throat dead white, sparsely dotted with dark, with a series of larger spots along the sides. Lower body and tail warm orange.

On the posterior half of the tail, the brown of the body gradually changes to rings, which form the proximal boundary of a series of pale brown bands. On the under side of the tail these light bands become brilliant white. The reason for this is apparent when I watched this individual lizard frightened. The tail curled far up and forwards over the back, forming a conspicuous, banded black-and-white banner. An enemy would certainly snatch first at this bright colored moving structure, and the tail then breaking off and beginning its frantic, isolation dance, the owner would escape. In the oviduct was a large, soft-shelled egg nearly ready for deposition.

*Hyoid:* Newly hatched, 24 hours old, (Text-fig. 1), No. 30,018, total length 30 mm. (KOH No. 2,500, Caripito, March 1, 1944). Glossohyal long and slender (1.7 mm.). It is hyaline except for one-quarter of its length beginning near the tip, this area showing considerable calcification. The clarity of the glossohyal continues to the division into the basihyals, all of which elements show solid calcification. At the lower part of this area is a distinct shoulder or socket from which spring the first two gill arches. The hypohyal arises from the upper rim of the shoulder, extending *horizontally* as an almost straight element, slightly larger in caliber at the base, and expanding distally into two, widely separated points. From the lower point a short, obliquely backward directed rod is seen, from which there arises the ceratohyal. So firmly is this pair of bones attached to the auditory apparatus that in dissection, both were torn away from their hypohyal attachment, remaining firmly fixed to the otic area of the skull. This extremity shows a solidified, large, flat, diaphragm-like expansion.

From the hypohyal socket itself arises the first ceratobranchial (1.7 mm.), the junction being by an enlarged, rounded, hyaline head, with considerable calcification immediately behind it, suggesting a hint of separateness which might justify considering it a hypobranchial relic. The distal extremity which is slightly calcified, gives rise to a slender epibranchial curved into a hook at the end. Although the hypohyal calcification ends abruptly at the socket, the arch extends posteriorly with no change in curvature and only a slow narrowing, as the sec-

ond ceratobranchials. These are elaborately developed and end in elongated, angular extremities, and at the very tips there is a minute, clawlike bit of cartilage, probably a vestigial second epibranchial. This entire third arch is quite devoid of calcification.

Adult breeding female, (Text-fig. 2), No. 30,093, total length 75 mm. (KOH No. 2501, Caripito, May 6, 1942). The hyoid of this adult female is actually only 32 per cent. or one-third larger than that of the day old specimen, and in eyeball diameter there is even less difference, an increase in the adult of only one-fourth or 25 per cent. Opposed to these organs so valuable to the newly hatched young lizard, are the relatively less important total lengths of young and adult, 30 and 75 mm., respectively, an increase of two and one-half times, or 250 per cent.

The hyoid of the adult gecko differs from that of the twenty-four-hour lizard in only a few important ways. The glossohyal is relatively longer and more slender, and the outward curve of the hypohyals is somewhat more pronounced. In my description of the juvenile hyoid I purposely italicized the *horizontal* position of the hypohyals, as being radically unlike that in the normal hyoid arch of adult geckos. In the present specimen these elements have swung forward quite 90 degrees into the specialized gekkonid position. This forward shift includes the entire hyoid arch, and seems to have brought about or perhaps may be said to have been the result of a loss of direct connection with the auditory apparatus, so that the end of the ceratohyal is well anterior to the end of the first ceratobranchial, and the extreme distal tip instead of being closely united to the diaphragm-like transverse element, dies out, and shows now, instead, a short separate bit of cartilage lying alongside its tip.

The first branchial arch shows little change except a shortening of the epibranchial, and the same is true of the terminal, irregular filaments of the second ceratobranchial.

*Breeding:* On March 1, 1942, at Caripito a gecko hatched from one of six eggs deposited under the bark of a rotten log by three or more females of this species. The eggs measured 6 by 7.5 mm., the newly hatched lizard 30 mm. over all. The color in life was dark brown with a series of orange-edged black spots down each side of the back. The tail ended in conspicuous bands, two white and two black. The tail was held high in the air from the first step after hatching, and waved from side to side when walking. March 2nd the lizard had shed and eaten its skin. From this night on, the change from dark brown to very pale body and intense black-and-white-banded tail

was very marked. A second egg contained an embryo only three-fourths developed, very lively but hampered by a considerable amount of yolk. Its most conspicuous markings were the shoulder stripes. It was 28 mm. over all, and the tail was very active. The other eggs were almost fresh, so that the entire six must have represented a communal laying on the part of several females.

*Gonatodes annularis* Boulenger, 1887.

*Names:* Spot-shouldered Gecko, Yellow-throated Gecko; Wood Slave (Guiana Creole); A-tah-zick (Akawai Indian).

*Range:* The Guianas.

*General Account:* This is the most abundant of the small species of geckos at Kartabo. Its favorite haunts are old stumps, hollow and fallen trees and the débris behind half-rotten leaf spathes of palms. I once found two at a height of thirty feet in a bromeliad. They were seen now and then in the laboratory but were not as conspicuous as *Sphaerodactylus*, nor as skilful in climbing vertical surfaces. They are less nocturnal than *Thecadactylus* and *Sphaerodactylus* although, like the latter, they have round pupils. They are active on cloudy days but I never saw them in bright sunlight.

The food of this species consists of small insects, especially termites, as well as collembolas, diptera and ants. A pet monkey caught and ate one without much zest, and repeated this on three occasions. The only other observed enemy was a large marine toad which devoured two, and a young trumpeter which killed but did not eat a spot-shouldered gecko which escaped from a vivarium.

These geckos are decidedly solitary and I never found a pair close together, but in three cases (twice in the vicinity of eggs) a male and a female were present in the same log. Twice I found a female actually touching the eggs, one and four eggs respectively. While only a single egg is deposited at a time, I am reasonably certain that as many as four may be laid at considerable intervals in the same cavity by the same individual. Eggs are always hidden beneath soft, fine débris well below the surface. When the female was found with the eggs, she too, was buried out of sight in the damp sawdust. Four-fifths of the eggs found were laid during the long wet season from April to September. One egg, kept under natural conditions, hatched after 52 days from the time of discovery, apparently indicating this remarkable length of time as a minimum period of development.

In one case I found two eggs buried in a termite nest, and a newly hatched dead lizard, showing that unlike tegus (*Tupinam-*



bis) in corresponding conditions, these weak geckos cannot free themselves when built in.

Whether the throat in this species of gecko is immaculate or distinctly lined is a character quite independent of age or sex, but in the adult male it seems invariably yellow. In sexually active males there is always a large amount of red on the dorsal surfaces. The dorsal irregular spotting or banding (see figure of coloration of type, *Proc. Zool. Soc. London*, 1887, p. 153) is often apparent in adult females and in the very young of both sexes. In five such individuals, females and young, very distinctly marked in life, not a trace remains in the preserved specimens.

Male adult (No. 189, Kartabo, June 27, 1919):

*Measurements*: Length 68 mm., head 9, tail 34 (renewed portion 31), eye diameter 1.7, snout 4, eye to ear 3.2, fore limb 11, hind limb 16 mm., weight 1 gram.

*Color in Life*: Head in general greenish-yellow, the lip scales all around above and below reed yellow (colors from Ridgeway's nomenclature), face markings olive yellow. (Pl. I, Fig. 3). These latter include a snout spot, an irregular line in front and another behind the eye, the head below the eye and back to and including the ear, and a small spot well above the ear. Dorsal body surface violet gray thickly granulated with Brazil red back to mid-body, where the red concentrates and forms two dorsal and two lateral lines of three to five large round spots. In front of the insertion of the fore limb is a large ocellus, black, banded with smoky, and with a wide vertical line in front and another behind of yellowish-white. Tail amber (broken off twice near base and grown completely again). Limbs tawny olive, the scales tipped with black. Chin, throat and lower neck bright olive ochre. Ventral body, upper arm and leg olive buff, tail from just beyond vent vinaceous fawn.

*Scalation*: The ventral scales are flat, well separated and with numerous fine black dots. A large area, rounded, abruptly marked on the posterior belly at equal distances from the vent and the insertion of the thighs, and an elongated area on the under side of each thigh, consists of specialized scales, much swollen and immaculate. Those on the thigh number about eight long and three or four scales wide. The ventral scalation of the renewed tail is very irregular, three or four transverse scales extending clear across, being followed by a broken irregular series of small scales, then more transverse scales.

Male adult, length 71 mm., tail 36, weight 1 gram (No. 782, Kartabo, May 17, 1922):

*Color in Life*: General color dark brown,

head variegated with red and green. Dark shoulder spot bordered behind by white line. Two light brown spots at base of tail above. Chin and throat and under parts greenish-yellow.

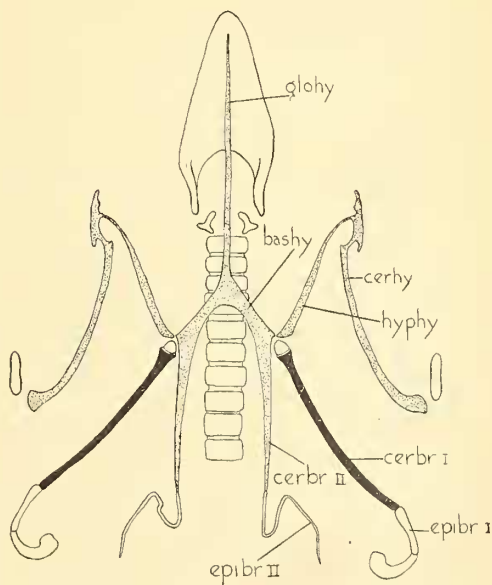
Female breeding (No. 558, Kartabo, August 9, 1922):

*Measurements*: Length 75 mm., head 11, eye 2, fore limb 10, hind limb 12, tail 41.5, weight 1.1 gram. Egg about to be laid.

Male adult, length 83 mm. (No. 531, Kartabo, March 8, 1922, Color Plate 330):

*Color in Life*: Head and back dark olive green with broad, rather irregular bands of carmine. The lores are wholly carmine, and three lines extend back from the eye, the lowermost curving up over the humeral ocellus. Labials and all four limbs light olive green. Chin and throat immaculate, apricot yellow. There is a large, roundish black spot on the shoulder with a slightly angular, very conspicuous broad white line extending transversely from the lower insertion of the fore limbs almost to the mid-back. In the same individual, preserved, only the black spot remains with all the red gone and the white line as an obscure gray shade. Otherwise the lizard is monochrome dull brown.

*Hyoid*: Male adult, length 65 mm. (KOH No. 2018, Kartabo, June 24, 1920. (Text fig. 3). Description and drawing checked with identical hyoid of No. 2020, same length and sex): Glossohyal or lingual process a slender, needle-like rod 3.5 mm. in length to the base of the forked but otherwise undifferentiated basihyals. The anterior 1.7 mm. of the glossohyal is covered with a broad, spear-shaped tongue core, 1.5 mm. wide



TEXT-FIG. 3. *Gonatodes annularis*. Hyoid.  $\times 10$ .

with two transparent posterior cornua. From their point of divergence, to the shoulder articulating with the arches, the basi-hyals measure 1.3 mm. The proximal element of the hyoid arch, the hypohyal, is represented by a slender rod of 2 mm. extending obliquely forward from the basihyal, curving slightly outward for the distal half millimeter, and connecting by a close-fitting joint with a curious, skate-shaped affair. From the inner side of this, two-thirds towards the rear, arises the long, slender, backwardly curved ceratohyal 2.8 mm., enlarging slightly but evenly throughout its length, and ending in a truncate, wide-flanged tip close to the ventral aspect of the auditory apparatus. The articulation of the first ceratobranchial shows a distinct, strongly marked, curved head, the remains of the hypobranchial. The ceratobranchial itself follows the general direction and length of the ceratohyal, but is slightly longer. The end of this part of the hyoid apparatus is strongly curved and distinctly divided into two distal segments, which may represent the epibranchial and perhaps the pharyngobranchial elements of the first branchial arch.

A third arch is well developed in this primitive little lizard. These second ceratobranchials extend back as two strong spines from the articular area of the basihyals, completing with them a general wishbone shape. From the end of each depends a long, delicate, thread-like strand of tissue, of perhaps degenerate epibranchial origin.

A cleared hyoid of *Gonatodes caudiscutatus* is identical with the above, except for a reduction in the size of the tongue core.

**Breeding:** On August 23, 1919, an egg of this gecko was found in a broken palm stub close to the laboratory at Kartabo. An adult female lizard was a foot away and was accidentally killed when captured. The egg must have been deposited some time before, as it hatched the same day.

I watched the lizard (Cat. No. 229) break the shell, uncurl and walk away along the edge of the glass dish. The egg was broken off irregularly, about one-quarter of the shell coming away in two large pieces. The egg measured 7 by 8 mm. and five minutes after hatching the lizard was 38 mm. in total length, the head being 8 mm. When slowly approached the lizard watched intently, its eyes moving independently, but the little creature remained motionless, except for a to and fro motion of the tail tip. This never ceased. When I moved, it scurried off with short, quick darts, the last remains of the yolk sac falling away, while a small bit of shell stuck to its throat for some time. When running, the tail was lifted in a long high curve.

The color was dull bluish-gray, faintly marked with small grayish-white spots on the head, and a series of ten larger separated spots extended in pairs down the back, joining on the rump and becoming bands on the tail. All these spots were preceded by dark areas. The most conspicuous marking, as in the adult, was the transverse prehumeral whitish lines, enclosing a large black spot. Beneath, the color in general was uniform bluish-gray, with the sides of the head, chin and throat marbled with shades of gray. The labials were very conspicuous, black with small, light-colored centers. The pupil was round, the iris with a bright, narrow outer ring of gold, the rest of the iris finely mottled with dull golden brown.

The new-hatched lizard seemed to get grayer and this was seen to be due to the loosening of the epidermis. Within half an hour after emerging from the egg, the skin began to peel off, beginning at the digits and working up the limbs and toward the tail, revealing beneath, intensely contrasting shades of gray and white. Within the first hour the entire skin had been pulled off and swallowed, finishing with a long shred from the tail. Whenever a bit of skin or dirt got on the eyeball, the tongue was run out sideways and quickly passed over the whole eye, thus taking the place of the eyelids.

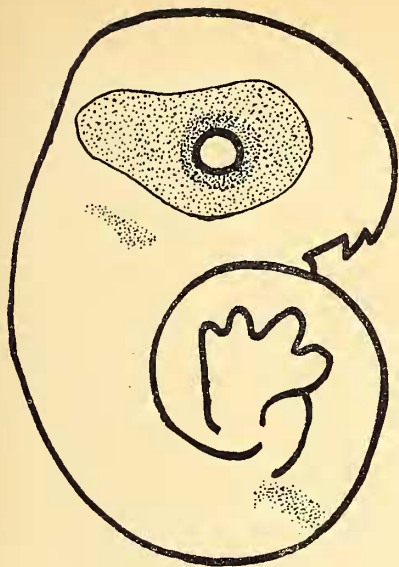
On July 18, 1920, five eggs were uncovered in three lots in the decayed stem of a spiny palm. (Pl. II, Fig. 4). The shells were hard, smooth and dull white. Weights averaged .15 of a gram, sizes 7 by 7.5 mm. In the case of the two pairs, each egg was separated from its fellow by about a week's development. In the two older ones which were about one-third developed, the embryo, except its head, was completely embedded in the thin yolk. The opaque blue-black eyes were of enormous size, (Text-fig. 4), pear-shaped, half as large as the entire head, which in turn was equal to or larger than all the rest of the embryo. The tail was rolled tightly, the four feet with their short, blunt digits all pressed close together.<sup>2</sup>

On April 29, 1922, an egg was washed out of a hole among roots in the river bank up-river from the laboratory. The embryo was within five days of hatching. This egg was unusually small for this species, 6.7 by 7 mm. The color pattern of the embryo was like the newly-hatched specimen (Cat. No. 229) with the shoulder spot even more emphasized, and in addition a pair of post-sacral, black-and-white ocelli. (Text-fig. 5).

On July 23, 1922, four eggs of this species

<sup>2</sup>This specimen shows, in addition to the large eye, two irregularly linear groups of dark chromatophores, one at the anterior part of the body, behind the eye, and the other at the beginning of the tail. These may very possibly be the first hint of the two pigmental concentrations so distinct in the late embryo.



TEXT-FIG. 4. *Gonatodes annularis*. Early embryo.TEXT-FIG. 5. *Gonatodes annularis*. Late embryo.

were found close together in the débris at the bottom of a decayed bamboo stub close to the laboratory at Kartabo. The shell of these eggs is thicker and tougher than that of a hummingbird. The average size was 6.5 by 7.4 mm. and the weights .25 of a gram.

The first egg hatched August 17, and when 24 hours old the lizard itself weighed .25 of a gram. It had not fed, except on its own skin, and the increase in weight must have been from the absorption of water. A second egg, opened on the same date, was one-third developed. The third egg, also opened on the same date, was four-fifths developed. In this embryo the shoulder ocellus was clearly marked.

The fourth egg hatched on September 13, at least 52 days after the egg was laid. Unlike the newly hatched gecko of August 23, 1919, the skin of this one did not loosen until six hours after emergence, and the method of sloughing was quite different. The epidermis of the entire head, body, limbs and tail became detached, the general color changing quickly to a pale smoky gray. When first observed the loose epidermis was

pushed back from the head, standing out in a ruff close behind the jaws. The gecko crawled about his cage, creeping under the lumps of sawdust and bits of bark in which the eggs had been found, pushing and working till the skin hung in tatters from his body. By turning his head far around, he at last got a piece of this in his mouth and tore off as much as would come and munched it down. He thus gradually freed his body and disposed of the débris, then pushed and rubbed again till the skin at the base of the tail was frayed. He made a tremendous effort, coiling around even beyond a complete circle in order to get a firm grip on the tail covering at its free edge; then he slowly straightened out and the skin peeled cleanly off in one piece, which made his next course. His legs were still completely encased, but he stripped them free very quickly and neatly as gloves are pulled off backward, each little toe covering being perfect as the owner gulped it down. The entire process occupied a quarter of an hour.

I kept the gecko alive for two weeks in a vivarium, during which time I fed it on eight termites. It grew very little. The com-

parative measurements are as follows, the first taken when twenty-four hours old, the second when two weeks of age: Total length 38 and 43 mm., head 6 and 7 mm., tail 20.3 and 22 mm., weight .25 of a gram and 3 grams.

***Gonatodes beebei* Noble, 1923.**

*Name:* Blue-eyed Chestnut Gecko.

*Range:* British Guiana.

*General Account:* This field name, which we used before identification, gives an excellent general idea of the appearance of this lizard. It is known from two specimens and two color plates. The lizards are in the collection of the American Museum of Natural History.

*Type:* N.Y.Z.S. No. 311, American Museum No. 21251, adult male, total length 94 mm., August 26, 1920. Color Plate 215, dorsal view, nat. size, head and neck enlarged; Color Plate 1175, iris. Topotype: No. 38972. (Pl. III, Fig. 5).

Noble's account of the coloring of the type after three years in preservative is as follows: "Uniform reddish brown above, whitish immaculate below, except for a slight suffusion of brown on the abdomen and appendages, this suffusion tending to form dark edges to the scales of the ventral surface of the thigh." His measurements of the type are as follows: "Tip of snout to vent 47 mm., tip of snout to ear 11.5, tip of snout to orbit 5.5, greatest width of head 7, vent to tip of tail 47 mm."

*Color in Life of Type:* Above chestnut shading through orange rufous on the sides to cadmium yellow on the chin and throat, and vinaceous russet on the ventral surface. A scattering of small black dots on back, tail and upper limbs. Iris light cerulean blue, and except for an inner pupil ring stippled everywhere with dark gray. Pupil round.

Caught on a fallen tree trunk in high jungle, five hundred yards from Kartabo laboratory. Kept alive for four days. Quiet, feeding well and amenable to handling. It frequently cleaned its eyes by running its tongue out and over them.

***Gonatodes booni* Van Lidth de Jeude, 1904.**

*Name:* Yellow-spotted Gecko.

*Range:* Known only from Surinam and British Guiana.

*General Account:* On April 15, 1924, I saw a species of gecko new to us, appearing brown and covered with small yellow spots. It escaped all our efforts at capture, running beneath an overhanging bank of earth in the jungle about three hundred yards from the laboratory at Kartabo. A month later, on May 16, I caught the same or another yellow-spotted gecko in the same bank, dig-

ging it out of a twelve-inch hole into which it had rushed. A week later, on May 24, I saw another individual of the same species only ten feet away from where we had taken our specimen. It eluded us. (Pl. III, Fig. 6).

Male breeding (No. 2833, Kartabo, May 16, 1924, Color Plates 740 and 741):

*Measurements:* Length 88 mm., head 12, body 31.5, tail 44.5, head width 8.5, body width 9, eye 2.5, fore leg 17.5, hind leg 28.5, testes 4.5 mm., weight 2.5 grams.

*Color in Life:* Background of upper parts of head and body blackish-brown, covered on head, face, throat, back and upper surfaces of fore limbs with rather closely spaced, irregular spots of empire yellow. These become duller and somewhat smudged on snout and anterior chin. Tail, hind legs and all four feet light russet-vinaceous, mottled with darker. The tail coloration extends up the mid-back in a wide, fairly definite line. Ventral surface primuline yellow under shoulders, shading backward to uniform tawny on under body and limbs, and russet vinaceous under tail. Inner rim of iris cerulean blue, remainder black flecked with light blue. (Pl. III, Fig. 7).

A changing phase of color shows all the spots much more brilliant and intensely orange, and the russet areas become decidedly orange in tone.

The only other specimen known is the type, collected in Surinam and now somewhere in Holland. Its color after preservation is described as "Upper parts dark green, covered all over with larger or smaller lighter spots composed by one, two or more granules of a light green color. Belly lighter without spots; gular region with large greenish spots. Tail without spots, below lighter than above."

***Gonatodes caudiscutatus* (Günther, 1859).**

*Name:* Ladder-back Gecko.

*Range.* Colombia, Ecuador and British Guiana.

*General Account:* No males were seen or secured and only three females. One of these was about to lay an egg on August 25, 1920. The dorsal markings were sufficiently distinct from those of related species to warrant our tentative field name of Ladder-backed, given long before I knew the actual taxonomic species. The vertical white shoulder stripe seems to be placed more posteriorly than in other species. One specimen possessed a very marked ability to change the shade of pattern, the black dorsal markings at night becoming almost invisible. On being annoyed the pattern returned in full strength.

Female adult (No. 598, Kartabo, May 21, 1922, Color Plate 366):



**Color in Life:** General color above grayish-olive, with irregularly longitudinal streakings of dark brown on head. (Pl. IV, Fig. 8). A broad vertebral stripe beginning at base of neck vinaceous buff, extending to insertion of tail. Two small, square patches of black almost meet over the shoulders across the dorsal stripe. The stripe is cut into along each side by nine symmetrical pairs of black points. Shoulder ocellus a large roundish spot of black, surrounded by a band of the general olive background, and this in turn by a still wider black frame, broken only on the posterior rim. Here a crescent-shaped narrow white line extends from the insertion of the fore arm to the mid-back. Side of head olive with fine darker markings and a lateral black line from lores through eye and on backward in a curve above tympanum to shoulder spot. Another black line from upper posterior eye backward and upward to top of head. Lips light olive with a line of black mottling along the lower labials. Limbs strongly mottled with dark brown. Tail with fine, irregular longitudinal markings of dark brown becoming black at tip. Sides of body finely mottled with olive, with two longitudinal lines of dark brown grouped in lengthwise dark spots. Ventral surface dirty white on chin, cream color on under body, mottled with gray under limbs and between fore arms. Under tail salmon buff.

Eyeball ochraceous buff, pupil round, iris dark mottled walnut brown with orange tawny border.

***Gonatodes humeralis* (Guichenot, 1855).**

**Name:** Black Wood Slave.

**Range:** Peru, Brazil and British Guiana.

**General Account:** Only five specimens were found at Kartabo and in the field they were confused with other species of the genus. No unusual habits were recorded, but the dark color was observed as setting them apart. In spite of considerable handling, the tails of this species seemed less deciduous than those of their fellow species.

**Color in Life:** Two types of patterning were observed, apparently distinguishing the sexes. An adult male, length 80 mm. (No. 3084, Kartabo, September 7, 1919) was very dark brown above, slightly paler on chin and throat, becoming still lighter under body and tail. The humeral spot was very faint in life and quite lacking in the preserved specimen. A female, 60 mm. long (268, No. 3117, Kartabo, August 3, 1922) was light brown with a pronounced humeral ocellus, a round, central black spot, surrounded by a ring of pale brown ground color and an outer frame of grayish-white. The back was plain but with a pair of light brown sacral spots, and six wide, pale caudal

bands. Below grayish-white with faint, converging bands on throat.

***Gonatodes ocellatus* (Gray, 1831).**

**Name:** Ocellated Gecko.

**Range:** Northeastern South America, Tobago and Trinidad.

**General Account:** No. 519, and a second in the American Museum of Natural History, No. 38784, appear to be the first recorded from British Guiana. I have no definite notes in regard to habits.

Male, body length 50 mm., tail gone (No. 519, Kartabo, March 21, 1922):

**Color in Life:** General color of head above and on sides and neck Brazil red. Chin and throat brilliant orange. Top and sides of head covered with elongated patches (two running up and back from eye) and markings of capucine yellow edged with black, while on the ventral surface chin, throat and neck these markings are rounded spots. A line of the same yellow extends across the back from shoulder to shoulder, touched with black and slightly broken in the mid-back. General color of sides oil yellow, finely mottled with Brazil red and black. One large and one small ocellus on each side of the body. Broad band down the middle of back and the limbs seal brown. At night the back and limbs change to a frosty gray. Ventral surface dusky slate violet, except for a small patch of terra cotta at base of neck and a median line under the tail of pompeian red. Pupil round, iris rim apricot buff, remainder hazel with dark stippling.

***Gonatodes vittatus* (Lichtenstein, 1856).**

**Name:** Gray-striped Gecko.

**Range:** Colombia to British Guiana, Trinidad and the Dutch Leeward Islands.

**General Account:** These geckos were of so indefinite a pattern and coloration that in the field they were not given a name or set apart from the females of *annularis*. At least five individuals were recorded, taken March 28, 1919 (2 specimens), July 4, 1920, July 16, 1920 (2 specimens), and June 4, 1922.

***Sphaerodactylus molei* Boettger, 1894.**

**Names:** Black-and-white-headed Gecko (male), Orange-tailed Gecko, Gray-headed Gecko (female); Striped Wood Slave (Guiana Creole name); Shallee-shallee (Akawai Indian).

**Range:** Northeastern South America and Trinidad.

**General Account:** This gecko shares with the larger *Thecadactylus* whatever advantages are yielded by life in human buildings. It was often found in both our Kartabo and Caripito laboratories, running at night over the walls and up the legs of our tables. It

creeps very slowly when stalking prey and at other times runs with short, quick darts. When frightened its short legs become inadequate, and progression is by a frantic sinuous wriggling, almost *Leposoma*-like. The tail breaks off very easily and the break is clean with almost no muscle ends showing, and on the body end there is usually sufficient overlapping skin to fold in and almost hide the fracture. The tail end, reasonably enough, is less protected by excess skin.

I made no detailed observations on the shape of the pupil in this species, taking for granted that it is always round, but in several photographs taken immediately after death one or both pupils appear as slightly vertical.

Male breeding, body 25 mm., tail 29 (No. 209, Kartabo, April 5, 1919, Color Plate 163).

*Color in Life*: Top and sides of head and neck jet black variegated with creamy white, chiefly in the form of two broken lines from the nostrils back over the eyes, forming an indefinite "Y" on the neck. (Pl. IV, Figs. 9, 10 and 11). Also a solid broad white line from the eye back to the abrupt ending of the black nuchal area in front of the fore limb. Body buffy green. Limbs very light, dotted thickly and irregularly everywhere with dark brown. Tail abruptly ochraceous-orange, the color resulting from many large spots set close together both above and below. Rostral, all labials, lower side of head and neck, the chin and throat yellow-green, remainder of ventral surface of body creamy-white. Pupil round, iris ivory white, finely dotted with large, dark brown crescentic marks, especially dense in front of and behind the pupil.

A 49 mm. male taken April 11, 1919, wholly lacks the central dorsal cephalic white spots, and the body freckling is confined to the sides and pelvic region.

Male, not breeding, body 25.5 mm., tail 27.5 mm., (No. 538, Kartabo, April 13, 1922, Color Plate 358):

*Color in Life*: General color above deep olive buff tinged with apricot orange on head and merging on the tail into capucine yellow. Groups of tiny picric yellow dots on orbits and before and behind orbits in vague lateral lines. All upper surfaces covered with scattered small spots of pecan brown, very faint on neck and fore limbs. These spots become heavier and darker brown on posterior body, and still heavier and more irregularly spaced and elongated on anterior tail. Beyond mid-tail they die out, the remainder being faintly mottled with gray. The dorsal spots arrange themselves either side of a plain narrow vertebral line, giving the effect of a dorsal body stripe. Side of

head primuline yellow. Broad lateral stripe of picric yellow from eye diagonally upward to sides of neck. This marking is strongly edged with black along each side, which color in turn shades into orange outer bands. The lower band extends forward through the eye, becoming fainter on the snout. Chin lemon chrome; ventral surfaces maize yellow. Under tail zinc orange. Toes grayish.

Pupil round. Inner iris rim ivory white. Rest of iris white with grayish stippling on outer edges. Fore and aft a wide band of walnut brown continues through the iris the loral-postorbital band.

Female, not breeding, length 46 mm. (No. 209a, Kartabo, April 11, 1919):

*Color in Life*: In general buff with the head and neck rather indefinite gray. Apparently unmarked except for two light flank lines, down each side of the dorsal pelvic region. In the right light, however, all the broad cephalic lines of the male are visible as lighter brown—i. e., the two lateral lines and the central "Y". The lateral lines extend very faintly down the body and, becoming strong at the pelvic zone, die abruptly at the caudal change to coarser imbricated scalation, which marks the area of regeneration.

*Color in Life of Young*: Young geckos show a uniform pattern. Many, such as one 30 mm. in length, taken May 4, 1922, are light buffy brown, with no trace of the dark cephalic bands of the adult. Two wide, pale brown bands start from the eye and extend back just above the limbs to the tip of the tail. These are faintly bounded with black. Here and there down these lines and also down the center of the back, are very small, brilliant, isolated yellowish-white scales. On the posterior half of the tail these increase in number, gather some black scales about them and form four light bands, the tip of the tail being almost white with a black sub-terminal band.

A very young gecko, 23 mm. total length, May 16, 1919, has the head dark grayish, body and tail olive. The eye to tail tip bands are very pronounced. There is a row of small, pale vertebral dots. Near the base of the tail are two pale lateral spots; beyond these a second pair almost join, and still farther are three pale creamy white bands, the most conspicuous markings on the young lizard. At night all markings except these caudal bands disappear.

*Food*: Small, winged wood roaches, red mites, ants and termites.

*Enemies*: On the night of July 3, 1920, by flash-light I surprised a ghostly white *Thecadactylus* on a jungle tree trunk with a small gecko in its mouth. My quick grab secured only the victim and the wriggling tail of the larger lizard. The unfortunate



gecko proved to be a 28 mm. *Sphaerodactylus molei*.

**Breeding:** No. 1934 was an oval egg, 5 by 7 mm., collected July 30, 1919, in a rotten stump, together with the female lizard which was about to deposit a second fully-formed egg. The egg in the sawdust was very stained and slightly dented, so I thought it was bad, but the embryo proved to be in perfect health and would have hatched in three or four days. It was packed tightly in the shell, and measured 33 mm. in length over all. The color was a dull mottling of several shades of brown with the two lateral body lines and caudal black and white bands well marked. Four separate times I placed it in absolute darkness in the photographic room, examined it after returning it to the light, and then re-examined it after exposure to strong daylight. In each case the gray mottling and to a less extent the lateral body lines became so faint that they were barely discernible. There was no change in the caudal bands. The embryo lived for five hours, and the color change tests were carried on in the first half hour, before I removed the lizard and measured it. In the case of this female there was a single large egg in the oviduct, and no trace of a less developed second. This was the case in three other instances, but not with gecko No. 2652, adult female, body length 28 mm., taken March 16, 1924, which was about to shed its skin. When I dissected this specimen I found two fully formed eggs about to be laid, 5.5 by 7 mm. The lizard was of typical color, buffy brown with gray head, and faint head lines.

***Hemidactylus mabouia*** (Moreau de Jonnes, 1818).

**Name:** White Gongasacka.

**Range:** Northeastern South America including Brazil, and the Antilles.

**General Account:** No notes were made of this species except that at least two specimens were taken, one of them in July, 1920, in the laboratory at night, appearing dead white unmarked even by black tail bands. No. 195 was found on a tree trunk September 25, 1917. In general large size and in the peculiar character of the vertical pupil this gecko recalls *Thecadactylus* rather than any of the genera of small lizards.

***Thecadactylus rapicaudus*** (Houttuyn, 1782).

**Names:** Large House Gecko, Cat-eyed Gecko; Gongasacka (Guiana Creole Name); Cang-gah-sah or Kingasah, "One-who-calls-in-the-house" (Akawai Indian).

**Range:** South America except southern part; Central America and the West Indies.

**General Account:** Almost anywhere in the warmer parts of the neotropical region,

when human beings first occupy a house they will find that two small native creatures have preceded them. One is the little tree frog, *Hyla rubra*, who considers the kitchen sink or a bath tub or rain barrel the equal of any jungle home. The other is the gray house gecko, *Thecadactylus rapicaudus*. Both are perfectly harmless, they are nocturnal, they can cope with smooth perpendicular surfaces by means of vacuum soles to their feet, and both have pleasant voices which are heard, now and then, throughout the night.

The cat-eyed gecko is common both at Kartabo and Caripito. Its normal haunts are decayed logs and hollow trees, and it also approves of the cavities behind the leaf stalks of palms. Half a dozen were always to be found in the laboratory at Kartabo, hidden away in solitary obscurity during the day, but creeping forth when our insect-attracting lamps were lit.

Out of dozens of these geckos collected, the following measurements of a male with a perfect tail are average. They are percentages of total length. No. 201, Kartabo, adult male, Dec. 23, 1920: Total length 144 mm., body 53 per cent., head 18, head width 10, snout to eye 7, eye diameter 3, fore leg 16, hind leg 21 per cent., weight 9.3 grams.

**Color in Life:** Adult. The thirteen words with which Boulenger (*Catalogue of the Lizards in the British Museum*, I, p. 112) characterized this gecko can hardly be improved upon. "Brown or greyish-brown above, variegated with darker and lighter; lower surfaces whitish, immaculate."

The variety of mottling and spotting in adult geckos is infinite. The most consistent marking is the olive buff of the labials, and a broad, irregular, pale olive brown stripe from the eye to the shoulder, bounded above and below by equally wide bands of dark brown. The complexity of the pigmental characters in general is increased by the occasional temporary appearance of fairly regular bars and spots down the back, at times when the creature is excited or alarmed, with a subsequent return to the heterogeneous pattern of calmer emotions. The tail is the most variable part, if such a superlative is possible, and no two are alike. Some are lined with a multitude of thin, hairlike, dark streaks, or waved indefinitely with several shades of gray or brown, or a dark background will have broken bands of lighter. Regenerated tails are usually without definitely contrasting markings. Immature geckos often show very regular markings, such as No. 30,009, under the next heading.

**Change of Color:** Temperamental change of color is sometimes very marked, but is never so radical as that from diurnal to

nocturnal color and pattern. This is especially pronounced in young and half-grown individuals. Typical was the change in No. 30,009 (Caripito, March 15, 1942, Color Plate 1508.) This immature specimen, which measured 125 mm. over all, was captured in the jungle under bark. In general it may be called vinaceous, with the top of the head, limbs and dorsal markings of body and tail light wine-colored, elsewhere darker. The two most brilliant areas are the golden eyes, and a narrow, single-barbed dead white line from the eye back along the side of the head. The head is coarsely dotted, the limbs blotched with dark vinaceous. Down the back are very conspicuous markings, light violet, divided narrowly into three, each of which may be described as a broad arrow head, directed posteriorly, with two extra pairs of barbs down its shaft, all surrounded and emphasized by a frame of black. The basal half of the tail has three wide bands of light violet, then an exceedingly wide band of black and a pale tip. (Pl. V, Figs. 12 and 13).

The lizard escaped in the laboratory and when caught late in the evening bore no pigmental resemblance to its diurnal phase. The whole animal had become pale pinkish-white, except for the dorsal markings which had paled to ivory white. The two conspicuous exceptions to this fading were the eyes and the broad black tail band which remained a broad black tail band.

Color change in another individual was less marked. A female, 112 mm. in total length, every night at 8 o'clock turned a brownish-white, with several small, irregular dark marks down the tail, marks which were quite absent in the diurnal patterning. After having been covered all night, at 6 in the morning the color was unchanged except for a decided tinge of olive green. After ten minutes' exposure to daylight the green increased in intensity, and a dark ground color began to appear, a deep olive brown, lighter colors being confined to irregular streaks on the head and a series of haphazard spots down the back. This sequence of color change was always the same whether the lizard was uncovered at 8 A.M., noon or 3 P.M. The change was unaffected by the regular rhythmic change of the twenty-four hourly shift from light to darkness, but influenced only by direct illumination on the gecko.

*Tail:* This organ is strongly prehensile, and when the lizard is clinging motionless to glass, the belly and tail are pressed so closely against the surface that it seems as if they must give material aid to the vacuum feet. Yet this gecko can walk on a dry, vertical glass surface with the body and tail raised clear. At moments of excitement the

tail is curved high in the air and waved slowly to and fro, doubtless as lure or bait to any enemy; an easily dislocated "pound of flesh" offered in exchange for the chance of escape. When the tail is detached there ensues a frantic twisting and wriggling, so violent that the entire tail flicks into the air again and again, before it slowly dies its isolated death.

The base of the tail is swollen and the ultimate zone of possible fracture begins at the posterior end of this swollen area, about 10 mm. behind the anus. On each side of the vent is a double tooth or spine-like scale. The regenerated tails lack much of the prehensile and coiling ability of the original and can never lie as flatly and as closely applied to any surface.

*Eye:* The eye of this gecko is magnificent. (Pl. V, Fig. 15). It is very large, adapted for nocturnal sight, perfectly round and with the lids reduced to tiny folds. The nictitating membrane, which is crumpled into a useless fold in our own eye, is here a convex "watch crystal" of hard, transparent tissue within which we can see the eye ball rotate freely. But though lids are absent, yet the eye is protected from excessive light by the great mobility of the pupil. In daylight there is visible only a narrow, vertical slit with opposing nicks which when pressed together leave four very small diamond-shaped openings, admitting sufficient light for the detection of danger and the performance of all necessary activities. The rest of the eye, the iris, in breeding males, is a splendid ball of glowing coppery gold, shot and zigzagged with veins of rich warm brown. In most females and less developed males, the iris is bright silver.

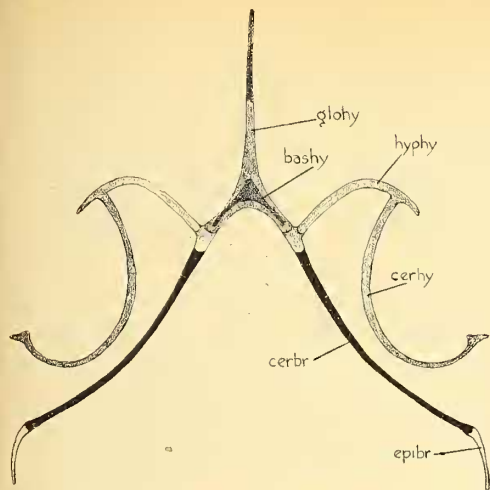
*Tongue:* The tongue is moderately protrusible and mobile. When some sudden alarm has passed the gecko will often "lick its chops" six or eight times, the tongue curling up and over the lips. In males in full breeding condition (No. 2923, Kartabo, Plate 759) the rounded tip of the tongue is a conspicuous bluish-violet. Vague hints of an elaborate courtship which have come to notice make it possible that these lingual colors may play a part. As in other geckos, the tongue functions as eye-lids and from time to time is passed over the eyes, cleaning them of any dust or other detritus.

Male, length 135 mm. (Kartabo, KOH No. 2034, July 5, 1920):

*Hyoid:* Characterized by the pronounced curve of the ceratohyal and the absence of any hint of a second branchial arch.

The basihyals send forward a long, slender lingual process, the glossohyal. The posterior bifurcations of the basihyals are wide spread, but short and not very thick. A tripointed core of dense cartilage marks





TEXT-FIG. 6. *Thecadactylus rapicaudus*. Hyoid.  
×5.

the juncture. The hyoid and first branchial arches arise from the tips of the basihyals, the former at right angles, and the latter continuing the arms of the basihyal forks. The hypohyals are wholly cartilaginous and bend sharply out and backward, ending in a hyaline tip. At right angles posteriorly to this transparent tip, arise the ceratohyals, long, slender and cartilaginous, and bent outward and upward into the form of an inverted half heart. The distal extremity is widened and flattened into a shoe of considerable size. The first branchial arch continues the line of direction (obliquely backward) of the basihyal bifurcations. This arch consists of the ceratobranchial, a very long, slender, outcurving rod with a strong core of bone. At the proximal point of juncture there is a tiny nodule of bone, representing the hemispherical cap of *Sphaerodactylus* and *Neusticurus*; probably the remains of a hypobranchial. The ceratobranchial terminates in a separate, slender, pointed segment of hyaline cartilage representing the remains of the first epibranchial. *Measurements*: Basihyal length 1.7 mm., width of forks 2.2, hypohyal 2.5, ceratohyal length (measured straight between tips) 4.5, ceratobranchial length 8 mm.

Checked with a second specimen, No. 3081 from Caripito, no difference is seen except that the ceratohyals are considerably less curved, more nearly parallel with the ceratobranchials. In this specimen, too, the end of the epihyal makes a narrow loop and connects directly with the area near the auditory apparatus. The more curved character of the ceratohyals in the Kartabo lizard may well be a mechanical contraction owing to loss of otic connection

and a subsequent lessening of longitudinal strain.

*Feet and Progression*: (Pl. VI, Figs. 16 and 17). The movements when these geckos are undisturbed are very slow and deliberate, recalling the ponderous progress of an elephant, the very antithesis of the nervous, waving, shaking little hands of a *Cnemidophorus* lizard. The raising and lowering of the feet is an interesting proceeding. At each step the whole foot is pressed down firmly, but without any sudden or abrupt movement, and there is nothing to indicate that the sub-plantar, vertical plates are developing most efficient vacuums. The loosening of this grip is amazing and unexpected, one which gives the same shock as the abnormal, boneless-appearing feats of an accomplished acrobatic contortionist. Starting with the very tips, all five toes slowly curl and roll up and back, until they are curved flat against the wrist or ankle, transforming the pentadactyl foot into a small, compact round ball whose surface is composed of backward-curved lamellae. The limb advances, is pressed down again and all five toes uncurl and are placed firmly on bark, wood or glass, as the case may be. This performance is completely lost to the eye when the gecko moves rapidly. We can illustrate what takes place by assuming that the back of our hands are the palms, and then walking them along a table top, with fingers extended and curled tightly in turn. Before I ever saw this in life I wondered why these lizards so often died with their digits curled far backward. Judging by the similarly flexed toes of preserved *Hemidactylus mabouia*, I should expect to find the same method of devacuation.

*Voice*: Now and then in the night we hear the call of this gecko in the laboratory at Kartabo, a high, rapidly reiterated *chick-chick-chick* or *chack-chack-chack*, fifteen or twenty times repeated, much like the note of some insect. It seems possible but not probable that besides being a sexual call this may be mimetic, alluring insects which may have somewhat similar notes. I should guess that the sound is mechanical, produced by some action of tongue and palate.

*Food*: These geckos will eat almost any insect they can catch. Several individuals learned to come every evening to our laboratory tables at Kalacoon and take small moths from the tip of our forceps. I once fed two of them some immature vile-smelling hemiptera and while the insects were swallowed, it was with reluctance and with subsequent licking of lips and rubbing of the sides of the mouth. The insects were very decidedly distasteful.

At Kartabo I once heard the clatter of an empty cigarette tin and the racket keeping up I went to investigate. The tin appeared to be jiggling about under its own steam. Beneath, I found a large gecko and a winged roach of largest size in a rough-and-tumble fight, which kept up after I had exposed them. The lizard had the insect by the head, but the great flapping wings prevented further ingestion for some time. The tin had been disturbed and fallen over the combatants but had not interfered with the row.

The stomach contents of four Kartabo geckos were as follows: (1), termite worker, beetle, red mite and moth fly; (2), many small insects and several spiders; (3), mollusk shell, small beetle, 3 moths, 2 flies, 2 flying ants; (4), 3 small wood roaches and 4 moths.

*Fighting and Courtship:* Whenever a full-grown gecko meets a small one of his own species, the latter shows his nervousness by a tremulous waving of the tail and any continued threat of approach results in headlong flight. Three separate times I saw adult geckos meet each other by accident in the laboratory, when there ensued much vigorous tail waving and licking of lips on the part of one, while in the other these actions were absent or were kept in low gear. On one occasion, one of the two *chack-chacked* three times in quick succession. Either because of my presence or the illumination from my lamp or flash, nothing further resulted.

*Enemies:* I can tell of only one enemy, and that of my own contriving. On April 6, 1919, I placed a *Thecadactylus* within reach of a pet cebus monkey. It was seized and when the tail fell off, the lizard was dropped and the monkey concentrated on the wriggling, dancing tail, which he grasped and ate. Ultimately he also caught and devoured the more quiescent owner, which had failed to make the most of his opportunity and get beyond the radius of the tethering chain.

*Breeding:* Female No. 3282, Kartabo, August 25, 1922, laid an egg in her vivarium. It was a very broad oval, 13.4 by 11.4 mm. and weighed 1 gram. The shell was hard and white originally, but when found it was completely covered with a fine mosaic of debris, bits of quartz, cast gecko skin and insect remains, giving it the appearance of a finely mottled, gray-brown egg. The debris was sunk deep into the shell structure and firmly fixed, as if the surface had been soft when the egg was laid, perhaps also mucilaginous, and the egg had been rolled about until thoroughly encrusted.

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## EXPLANATION OF THE PLATES

## PLATE I.

- Fig. 1. *Gonatodes albogularis*. Head and shoulder.  $\times 3.5$ .  
 Fig. 2. *Gonatodes albogularis*. Natural size.  
 Fig. 3. *Gonatodes annularis*. Head and fore body.  $\times 5$ .

## PLATE II.

- Fig. 4. *Gonatodes annularis*. Four eggs in a bamboo stub.

## PLATE III.

- Fig. 5. *Gonatodes beebei*. Head.  $\times 2.7$ .  
 Fig. 6. *Gonatodes booni*. Natural size.  
 Fig. 7. *Gonatodes booni*. Head and fore body.  $\times 5.6$ .

## PLATE IV.

- Fig. 8. *Gonatodes caudiscutatus*. Head and fore body.  $\times 8.3$ .

- Fig. 9. *Sphaerodactylus molei*. Natural size.

- Fig. 10. *Sphaerodactylus molei*. Head enlarged, dorsal view.  $\times 2.5$ .

- Fig. 11. *Sphaerodactylus molei*. Head enlarged, lateral view.  $\times 6$ .

## PLATE V.

- Fig. 12. *Thecadactylus rapicaudus*. Day coloration.

- Fig. 13. *Thecadactylus rapicaudus*. Night coloration.

- Fig. 14. *Thecadactylus rapicaudus*. Natural size; renewed tail.

- Fig. 15. *Thecadactylus rapicaudus*. Head and fore body.  $\times 2.6$ .

## PLATE VI.

- Fig. 16. *Thecadactylus rapicaudus*. Sole of foot.  $\times 7.6$ .

- Fig. 17. *Thecadactylus rapicaudus*. Toes reverted.  $\times 2.2$ .